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HOME AND FARM CANNING

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INTRODUCTION

For several years requests for information regarding the home canning of fruit and vegetables have been received at the station with increasing frequency. To supply this information it has been found

necessary to test the various methods generally recommended. This has been done both with the appliances used in most homes and with a special canning outfit constructed for home and small-scale operations.[1] In the course of this work several useful new methods have been devised. This circular is intended to describe these new methods and also to give general information asked for by numerous enquirers.[2] For a more complete discussion of the principles involved, the reader is referred to the correspondence course in "Canning and Preserving," given by the Division of Agricultural Education of the University of California.

A large quantity of fruits and vegetables goes to waste every year or is sold at prices which return little profit. Much of this, while unsuited to the special requirements of the commercial cannery or drier, is well adapted for home use if properly canned. The quality may be as good or better than that of the product of the commercial canneries, if put up with the proper knowledge and care. It is often possible to find a limited market for home products of this kind at profitable prices.

Local and private markets are usually the most satisfactory for the home or farm canner. He will seldom find it profitable to sell on the general market through jobbers in competition with the commercial canneries. With careful attention to all the details of the work and a little business ability it will often be possible to make the home canning outfit a useful adjunct to the orchard and garden, and much of the work will be found agreeable and profitable by the women of the household.

Causes of Spoiling.—The principal aim of canning is to prevent the material from spoiling. Spoiling is not due directly to the action of air or of heat. It is not a simple chemical nor physical change. When vegetable matters ferment, decay or turn sour, it is because of the growth of certain microscopic, living organisms or "germs." These all belong to the vegetable kingdom and are divided into three groups: molds, yeasts, and bacteria. Familiar examples of each group are the blue-green mold of spoiled fruits, the yeast used in bread-making, and the bacteria of the scum and "mother" of vinegar. What we see in compressed yeast, for instance, is simply a mass consisting of millions of germs. Individual germs are too minute to be seen without a microscope. Their activities cause the molding of jellies, the swelling and souring of canned fruits and vegetables, and the ptomains of canned meats. The character of the material largely determines which type of spoiling will occur. Acidity is favorable

to yeasts and molds. Fruits may therefore spoil by yeast fermentation or become moldy. Bacteria prefer a medium with little or no acid. When vegetables decay it is therefore usually due to the action of bacteria. Neither fruits nor acid vegetables are favorable to the growth of the bacteria which produce the poisonous ptomains sometimes found in spoiled meats.

Methods of Preserving.—The micro-organisms which cause spoiling come from the air or from the surfaces with which the material comes in contact. They can no more develop from non-living matter than wheat can appear spontaneously in soil devoid of wheat seed. In food preservation, we are dealing with living organisms, whose activities can be prevented in one of two ways: We may kill all the germs present by heat or other means and prevent the entrance of all others, or we may make the conditions so unfavorable to the germs that they cannot grow or do any damage. The latter way is followed when we impregnate meat with so much salt that bacteria cannot grow, or add so much sugar to jam that yeast cannot multiply. The heat method is utilized in most methods of canning.

Sterilization by Heat.—The killing of all germs present is called sterilization. In canning, this is accomplished by heating. The material to be preserved is placed in a vessel, jar, or can, in which it is sealed hermetically, i.e., made air-tight. It is then heated to a temperature fatal to all the germs it contains. No spoiling can then take place until the vessel is opened, as there are no means by which germs can enter.

Molds and yeasts, as they occur on fruit and vegetables, are quickly killed at temperatures several degrees below 212° F., the boiling point of water. In most cases, in fact, they are killed at temperatures of between 150° F. and 165° F. On the other hand, bacteria occurring on vegetables are much harder to kill, many of them withstanding the temperature of boiling water for an hour or more. These bacteria owe their astonishing resistance to the presence of spores. Spores are to bacteria what seeds are to higher plants and are resistant for the same reasons, viz., because of their thick, tough coats and low water content.

These bacteria, with resistant spores, probably occur also on fruits, but it is not necessary to kill them in this case, as they are very sensitive to acidity and therefore cannot grow in fruit juices. With vegetables the case is different. These, with the exception of tomatoes, have little or no acidity and are well suited to the growth of the heat-resistant bacteria. To sterilize vegetables it is therefore usual to heat

the sealed cans to temperatures above 212° F. The temperature can be raised to 212° F. by placing the sealed cans in an open tank or pot containing boiling water. Under these conditions no higher temperature can be reached, as the evolving steam removes the excess of heat as fast as it is applied. In a closed space where the steam cannot escape, however, higher temperatures can be obtained. As the temperature rises the pressure increases. In canning vegetables, pressures of three to fifteen pounds to the square inch are generally used. This corresponds to temperatures of 221.3° F. to 249.1° F.; the higher the pressure the higher the temperature.

Temperatures of 230° F. and over can also be obtained by adding ordinary salt or calcium chloride to the water in which the sealed cans are heated. The salt raises the boiling point of the water.

Fractional sterilization.—Vegetables may also be sterilized by repeated heatings to 212° F. If heated to this temperature the ordinary bacteria are killed and the spores are softened so that they sprout easily and rapidly. If the heating is repeated therefore twenty-four or forty-eight hours later the sprouted spores are killed. A third heating after a similar interval usually destroys all spores.

New methods of sterilizing vegetables.—The high temperatures or repeated heatings used in the canning of vegetables are not only troublesome and expensive, but injurious to the flavor and texture. Experiments in the zymological laboratory have developed a very simple and certain way of sterilizing vegetables as easily as fruit. This consists in the addition of a little acid to the liquid in which they are canned. It was found that peas heated to 212° F. in a brine acidified by the addition of five ounces of lemon juice to every gallon, kept perfectly, while peas heated in the same brine without lemon juice spoiled. The same results were obtained with beans, pumpkins, beets, turnips, artichokes and asparagus. Large quantities of these vegetables are lost by "spoilage" in the commercial canneries. The flavor of the vegetables sterilized at the low temperature was much superior to that of those sterilized under pressure.

The common household practise of canning corn and tomatoes together owes its efficacy to the same principle. Corn alone is very difficult to sterilize, owing to its lack of acidity. This lack is supplied by the tomatoes and the mixture is easily preserved by ordinary heating. Doubtless other wholesome acids, such as vinegar, citric, or tartaric acid, could be used for the same purpose. The amount of acid used is small and improves rather than injures the flavor.

Sterilizing fruits at low temperatures.—Heating fruit to 212° F. always changes more or less the flavor, texture and appearance. In

a few cases, the change of flavor, due to cooking, may be an improvement, but in most cases it is desirable to retain as much of the original character of the fruit as possible. This is accomplished by careful handling and by heating to the lowest temperature that will insure sterilization. Experiments continued for two years at the zymological laboratory have shown that certain fruits can be safely sterilized at temperatures of from 165° F. to 175° F. Peaches, apricots, pears, cherries, and berries have been successfully preserved after sterilizing at these temperatures, and have retained much more perfectly the texture and flavor of the fresh fruit than when subjected to the higher temperatures generally used in canning. The improvement with peaches was particularly marked.

In this method the cans are filled with fruit in a fairly heavy syrup—30°–50° Bal—(See page 16); exhausted three minutes at 150° F.; tipped and placed in hot water kept at 175° F. They are left in this water for ten to twenty minutes with occasional stirring to hasten the penetration of the heat. They are then removed and allowed to cool.

Preservatives.—Food materials can be prevented from spoiling by the use of certain substances known as preservatives. Some of these are injurious to health and forbidden by the pure-food laws. Others are not encouraged by pure food laws, because they are used by unscrupulous manufacturers to cover up defective materials or careless methods of manufacture.

Certain preservatives, however, are useful and permissible. For fruits, sugar is the most commonly used. If the sugar content of fruit juice, jelly or jam is raised to 65° Bal. by evaporating part of the water, or by adding sugar, they become unsuitable to the growth of micro-organisms and will keep even in open vessels. This is why dried fruit does not spoil and why jam must be made sweet.

For vegetables, salt is extensively used, as in preserving olives in barrels and in keeping certain types of pickles. Vinegar and spices are used in the same way. Sometimes a combination of the effects of heat sterilization and preservatives is used as in the new method of preserving vegetables described above. Heating to 212° F. destroys the molds and yeasts and the addition of citric acid prevents the growth of bacteria.

Methods of Home Canning.—The principles and theory of canning are the same whatever the scale on which it is done. The differences are only in the mechanical details of the methods of applying these principles.

There are two general methods in use. In one, known as the "Hot-pack method," the material is cooked in open pots and poured while hot into the cans, together with the hot brine or syrup. The cans are sealed immediately and sterilized. In the other, the "Cold-pack method," the freshly prepared material is placed cold in the cans and then covered with the hot syrup or brine, sealed and sterilized. The material is always hot when the cans are sealed. Only the cold-pack method is described here, as it is generally the best, especially for home use.

a *b* *c* *d* *e* *f* *g*

Fig. 1.—Common kitchen utensils useful in home canning: (*a*) Dishpan for peeling receptacle, etc.; (*b*) pots of various sizes; (*c*) small scale; (*d*) measuring cup; (*e*) peeling knives, spoons, and small utensils; (*f*) five-gallon pot for syrup; (*g*) collander or strainer.

OPERATIONS, MATERIALS AND EQUIPMENT

General equipment.—Most of the utensils and materials needed in home-canning are to be found in all kitchens. They include a good stove, or other means of heating, a large table for the preparation of materials, a sink and good supply of water, various agateware pots, saucepans, and buckets, large cooking spoons, and a sufficient supply of sugar and salt. To these should be added a good thermometer, suitable for placing in liquids, and reading from at least 32° F. to 250° F. (cost, about $1.00). A Balling or Brix saccharometer or sugar tester is also very useful. It should read from 0 per cent to 70 per cent and costs about 75 cents. For use with this will be needed

a tin cylinder to hold the liquids to be tested. It should be about 1½ inches in diameter and about 12 inches long. (See page 14.) The thermometer and saccharometer can be obtained through a drug store.

Other necessary or desirable materials are described in the following paragraphs. If the canning is to be done on a somewhat larger scale for the market it will often be advisable to purchase a factory-made outfit which may be obtained in various sizes.

Jars.—Glass jars are preferable to tin cans for home use. They can be used repeatedly; they present no danger from tin poisoning and the contents are more attractive in flavor and appearance. Their greater initial cost is offset by these advantages. Where the product is to be sold, it is usually necessary to use cans unless special high quality is demanded and a price sufficient to cover the extra cost of jars can be obtained. One commercial cannery in California owing its success to the high quality of its fruits preserves them principally in glass.

Glass jars are to be found in a variety of sizes and shapes and with various methods of hermetic sealing. The sizes most used are pints and quarts and to a smaller extent half-gallons. The only important variation in shape is the width of the mouth which may be as wide as the jar or only about half its width. The commonest method of sealing is by means of a rubber ring which fits between the cover and the top of the jar.

In the Mason jar and its various modifications the cover is a screw cap which makes an hermetic joint when screwed down on the rubber ring. In the ordinary form this cap is of zinc with a porcelain lining. This is the commonest and cheapest form. Wide-mouth Mason jars are now made which are very convenient for large fruits. They have enamelled metal caps which are often difficult to remove and may be broken in opening the jar.

In another common form, of which the Atlas is an example, the cover is a glass disc held in place and pressed down on the rubber by means of a strong wire clamp. After the fruit cools the clamp may be removed and the cover will be held in place by the vacuum. This affords a convenient means of detecting spoiled jars. If there is any fermentation of the fruit the gas formed will fill the vacuum and the cap will be loosened. This is a very convenient and durable form of cover and there are no metal parts in contact with the fruit.

Vacuum Seal glass jars are used in jelly and preserve factories. They have an enameled metal cap resting on a heavy, soft rubber ring and held in place by a vacuum inside the jar. This vacuum is pro-

duced in factories by means of an expensive machine. For home use these jars may be sealed by forcing the caps on by hand, while the contents are hot. On cooling, a vacuum is produced which holds the caps firmly in place.

In all cases where rubber is used in sealing it must be specially treated, as it will otherwise give a disagreeable taste to the food. Fruit and vegetables are often completely spoiled by this taste. It can be avoided by thoroughly treating the rubbers with a hot alkaline, followed by a hot acid solution. They are first boiled for several hours in water made alkaline with two or three tablespoonfuls of washing soda to the gallon. They are then rinsed and boiled a second

a *b* *c* *d* *e*

Fig. 2.—Types of jars used in home canning: (*a*) Removable clamp and glass top; (*b*) fixed clamp and removable glass top; (*c*) lacquered metal clamp top; (*d*) wide mouth screw top of lacquered metal; (*e*) ordinary narrow mouth screw top, with porcelain or glass-line cap.

time in water made slightly acid with lemon juice or vinegar. A third short boiling in plain water fits them for use.

In some forms of jars, the rubber ring is replaced by a ring or disk of pasteboard treated or varnished. These are not commonly used and are less generally suitable.

A commoner type that avoids the use of rubber is the Economy jar and its modifications. The cover is an enameled metal disc around the end of which runs a small groove filled with a hard wax-like compound. When the jar and its contents are heated this compound melts and seals the cover to the jar when it cools and hardens. A metal spring holds the cover in place until the compound hardens and may then be removed.

Cans.—There are three general types of cans used for fruit and vegetables—the "wax-top," the "solder-top," and the "sanitary."

With the *"wax-top,"* the cover is sealed on by means of a ring of hot sealing-wax. It is suitable for use with fruits and tomatoes, but it is not satisfactory for most vegetables, which require high temperatures necessary. They are easily manipulated and require no special equipment.

"Solder-top" or "stud-hole" cans with the necessary soldering tools are used in the factory-made home canning outfits and can be used with any outfit. The top of the can has a circular opening varying in width with the size and type of cans. After filling the

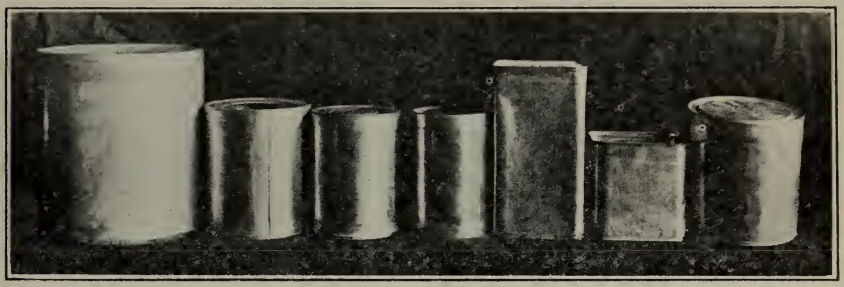

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Fig. 3.—Types of cans used in home canning: (*a*) No. 10 or gallon solder top can; (*b*) No. 3 solder top can; (*c*) No. 2 solder top can; (*d*) No. 1 tall solder top can; (*e*) No. 2½ square tall solder top can for asparagus; (*f*) small square solder top can for asparagus; (*g*) wax top can.

can, this opening is closed by soldering on a tin disc. This disc is usually perforated with a small hole to allow steam to escape during the preliminary heating. This hole must be closed with solder before the final sterilization.

"Sanitary-cans" used in large canneries are not sealed with solder. The cover or cap is "crimped" on by means of a special machine. There is a "composition" coating on the cap where it comes in contact with the can which makes the sealing doubly sure. The necessary machine is expensive and not suited for home use. A cheap hand-power machine can be obtained, but according to Dr. Bitting of the National Canners' Laboratory, its work is not satisfactory.

Cans are to be obtained which are coated inside with a protective enamel. These are suitable for very acid fruits, rhubarb and beets, as they minimize the action of the acids on the tin.

The capacity and dimensions of the cans most used for fruit and vegetables are given in the following table:

DIMENSIONS AND CAPACITY OF USUAL CANS

	SANITARY			SOLDER TOP	
Number	Height	Diameter	Capacity	Height	Diameter
1	4	2⅜	11.6	4	2 11/16
2	4½	3⅜	21.3	4 9/16	3⅜
2½	4 11/16	4	31.2	4¾	4
3	5	4¼	35.0	4⅞	4 3/16
10	6 15/16	6⅛	107.0	6⅞	6¼

Outside dimensions in inches.
Capacity in fluid ounces.

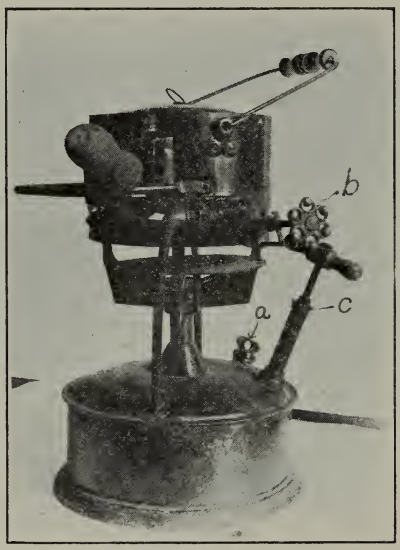

Fig. 4.—Gasoline torch used in heating capping and tipping steels: (*a*) Inlet for gasoline; (*b*) burner cock; (*c*) air pump.

In commercial canning, No. 2½ cans are commonly used for fruits and tomatoes, No. 2 for peas, beans and corn, and square No. 2 for asparagus. Apples and "pie" grades of fruit are usually put in No. 3 or No. 10 cans. Many other sizes and shapes are used for special purposes.

Soldering Material.—To fasten the caps on the cans, a *"capping steel"* is needed. This is a cylindrical soldering iron with a concave end to fit over the cap with which it must correspond in size. *Solder-hemmed caps* are furnished with a ring of solder. Their use saves much time, labor and solder. The small vent hole is sealed with a *"tipping-steel"* which is a small, pointed soldering iron. (See fig. 5.)

In order to make a good union between the solder and the tin, the surfaces must be cleaned with a "*soldering flux.*" This can be bought ready for use or can be prepared as follows: Place about one ounce of zinc in half a tumbler of strong muriatic (hydrochloric) acid and leave until bubbles cease to come off. If all the zinc dissolves add more until a little remains after all bubbling ceases. The solution is then strained through a cloth. It will keep indefinitely and must be diluted with an equal volume of water before using.

A gasoline *fire pot* or *torch* of the type used by plumbers is needed to heat the soldering irons. One like that shown in Fig. 4 or smaller is satisfactory.

Starting the torch.—The reservoir of the torch is filled about three quarters full of good gasoline. The air pump is screwed into place (see Fig. 4*c*), and air pumped in to give as much pressure as possible.

The cocks of the two burners (see b, Fig. 4), are then opened very slightly to allow a little gasoline to flow out and wet the burners. They are then closed and the burners heated by burning off the gasoline. This process is repeated once or twice until the burners are hot enough to vaporize the gasoline rapidly.

When the burners are sufficiently hot, the cocks are opened a little and the gasoline lighted. The flame should burn with a blue color and a roaring sound. The torch is then ready to heat the steels.

Tinning the capping steel.—The steel is heated sufficiently to melt a piece of solder instantly, but not to burn it. The bottom of the steel, both inside and out, should then be cleaned by filing off the scale. It is then dipped quickly into a little of the soldering flux and "tinned" by applying wire solder which should melt rapidly and cover the bottom of the steel with a bright metallic layer. This layer should extend to about one-half an inch from the bottom. The steel may also be tinned by filing it clean while hot and dipping into a mixture of sal ammoniac and small pieces of solder.

This process need not be repeated until the steel becomes accidentally too hot and burns off the "tinning." If the steel is wiped occasionally while hot with a coarse cloth and dipped regularly into the soldering flux when used the coating should last indefinitely.

Soldering the Cap.—The grooves around the tops of the filled cans are wiped to clean them from juice and pieces of fruit and the caps applied. A brush dipped in solder flux is then passed around the groove. The capping steel, heated until it will melt solder instantly, is cleaned by dipping in solder flux and applied immediately to the groove of the can. If plain caps are used, a little solder is melted around the bottom of the steel and allowed to run into the groove.

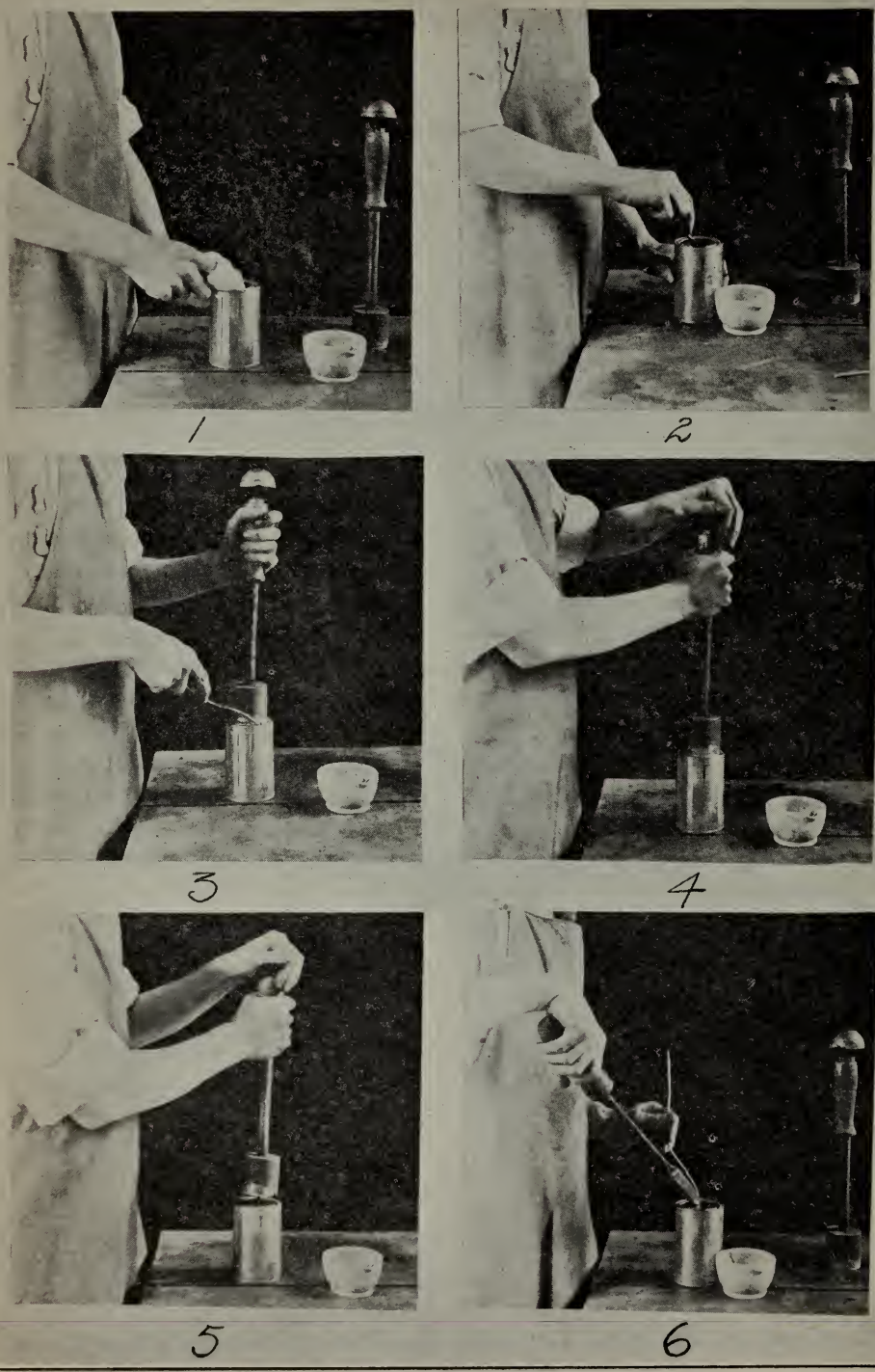

Fig. 5.—Sealing a solder top can. (For description see opposite page.)

Only a little is necessary. If solder hemmed caps are used no other solder is needed. The steel is turned a few times to distribute the melted solder evenly in the groove and then slightly raised while pressing down on the center rod for an instant until the solder hardens. (See Fig. 5.)

Tipping.—This term means the closing of the small vent hole in the top of the can with a drop of solder. It is done while the contents are hot and before sterilizing. The edges of the holes are cleaned with a brush dipped in solder flux. Very little must be used or it will run into the can and injure the contents. After applying the flux, the properly tinned and heated tipping steel is applied to the

Fig. 6.—Knives used in canning: (*a*) Peeling knife; (*b*) cutting knife; (*c*) peach pitting spoon; (*d*) pear coring knife.

hole and touched with a piece of wire solder. This causes a small drop of melted solder to run to the point where it closes the hole and is smoothed by a quick twist of the steel. (See Fig. 5.)

Preparation of material.—Nearly all fruits and vegetables require some kind of preparatory treatment before canning. They may

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Fig. 5.—Sealing a solder top can.

1. Wipe the juice and syrup from the groove.
2. Apply cap and wipe the groove with a brush dipped in soldering fluid.
3. Place clean hot capping steel on can and melt a little solder into groove.
4. Turn the hot steel to distribute the solder.
5. Press down on center rod, and raise steel a few seconds to allow solder to harden.
6. After exhausting can wipe vent hole and seal vent with a drop of solder.

require washing, sizing, sorting for color or ripeness, peeling, pitting, coring or slicing. Each requires special treatment which is described later. In some cases special machines or tools are necessary. Some simple tools generally useful are shown in Fig. 6. These are (*a*) a knife fitted with a guard to prevent excessive waste of pulp in peeling, and a broad knife (*b*) for cutting and slicing. For clingstone peaches a special spoon (*c*) with sharp edges is used. This is forced into the peach from the stem end and given a rotary motion which cuts the pit from the flesh and permits its extraction. A curved spoon or knife (*d*) is used for removing the cores of halved pears.

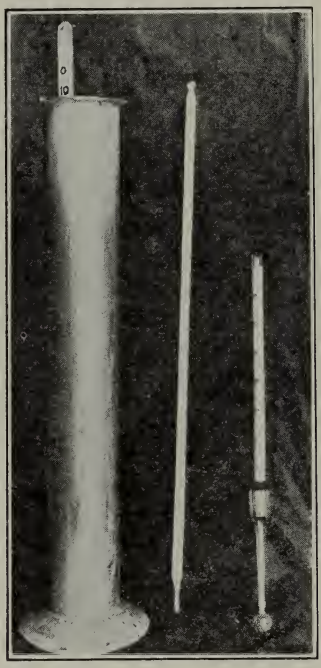

Fig. 7.—Tin cylinder, thermometer, and Balling sugar tester. The tester in the cylinder of syrup is read at the surface of the liquid. In the above case, this is approximately 12 per cent.

Blanching.—Certain vegetables should be "blanched" or parboiled before canning. This is done by dipping them in boiling water. A wire screen basket or a frying basket, such as is used in cooking doughnuts, will serve to hold the vegetables while they are dipped in a large cooking pot containing boiling water. This treatment

improves the quality, by removing slimy matters and lessening the astringent taste of the skins. It is necessary with asparagus to remove bitterness.

Exhausting.—This process is necessary with nearly all air-tight containers which are to be sterilized by heat. It consists of a preliminary heating before sealing and before the final sterilization. It results in expanding the air inside the container and thus driving out most of it. When the sealed container and its contents cool, the small amount of air still enclosed contracts and produces a partial vacuum. If cans are sealed while the contents are cool they will swell on heating, owing to the expansion of the heated air. Exhaustion is also necessary with jars. If the covers are screwed or clamped on, the expanding air may break the glass. If they simply rest on the rubber or other sealing ring the vacuum is necessary to keep them in place.

If the fruit is hot when placed in the cans or jars they may be sealed and sterilized immediately as the heat will exhaust the air sufficiently.

Syrup.—Fruits are canned in sugar syrups of various strengths or concentrations. In general, the more acid fruits require the most sugar. The appropriate strengths are given in the directions for canning the various fruits.

Brix or Balling sugar testers.—Syrups of the desired strengths may be made up by weighing the sugar and measuring the water, or by adding sugar to the water until the desired strength is indicated by the sugar tester or hydrometer. This is sometimes called a saccharometer and the commonest forms are the Brix and the Balling. The hydrometer is floated in the syrup contained in a tall, narrow metal or glass cylinder and the per cent of sugar read off from the scale at the surface of the liquid. If the syrup is cold the reading is correct enough for the purpose, but if very hot the reading may be 4 per cent too high. (See Fig. 7.)

Baumé sugar tester.—This is a hydrometer similar in form to the Brix, differing only in the scale, which reads in degrees instead of per cents. The degrees may be multiplied by two to give the per cent approximately.

Strengths of Syrup.—By carefully measuring the sugar and water, syrups of any desired strengths can be made up. The following table shows the relation between the sugar per cent, the Baumé degree and the proportion of sugar and water:

SUGAR SYRUPS

Per cent of sugar (Brix or Balling)	Baumé Degrees	Weight of sugar Per 1 gal. of water
5	2.8	0 lbs. 7 oz.
10	5.5	0 15
15	8.3	1 8
20	11.1	2 2
25	13.8	2 13
30	16.5	3 10
35	19.2	4 7
40	21.9	5 10
45	24.6	6 14
50	27.2	8 6
55	29.8	10 4
60	32.4	12 10
65	34.9	15 11

In making up syrups from this table, the weight of sugar in the last column opposite the desired per cent or degree is added to each gallon of water and dissolved by warming and stirring. The volume of syrup obtained is greater than that of the water used. The increase of volume is very slight with syrups of 5 per cent to 15 per cent, but is greater with more concentrated syrups; 15 pounds 11 ounces of sugar and one gallon of water giving nearly two gallons of syrup at 65 per cent.

Cane and Beet Sugar.—In numerous tests made by Dr. Bitting of the National Canner's Laboratory, by G. W. Shaw, formerly of the California Agricultural Experiment Station, by the Enology Laboratory, and by others, beet sugar was found to give results equal to those of cane sugar. The prejudice against beet sugar may have been warranted when the methods of manufacture were crude, but it can now be produced in as pure a state as cane sugar with which it is identical chemically.

Brines.—Most vegetables are canned in a light brine with or without addition of a small amount of sugar. The desired strength of brine is obtained by adding a weighed amount of salt to a measured volume of water. The number of ounces of salt to be added to a gallon of water for brines of various concentrations is given in the following table:

BRINES

Per cent of salt in brine	Ounces of salt per gal of water
1	1⅓
2	2⅔
3	4
4	5⅓
5	6⅔
10	14¼
15	22⅔

Sterilizers.—A sterilizer is a covered vessel in which the filled cans or jars are heated to the degree and for the time necessary to sterilize their contents. The sterilizer containing the cans and several inches of water is placed on a stove, and steam generated by boiling the water heats the cans. The cover must be sufficiently close to insure steam heat in all parts of the vessel, but must not be too tight, or the steam pressure will cause the vessel to burst. An ordinary wash boiler fitting the top of a kitchen stove can be made to serve as a very satisfactory home sterilizer. A piece of heavy wire screen of half-inch mesh and cut to fit should be placed in the bottom. This will serve to

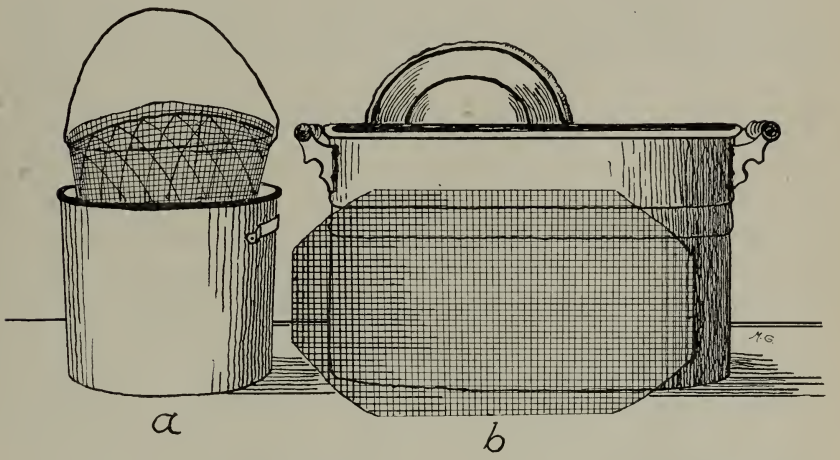

Fig. 8.—Apparatus used for blanching vegetables and sterilizing fruits and vegetables. (*a*) Blanching basket and pot; (*b*) wash boiler sterilizer, showing screen used as false bottom.

keep the jars from contact with the bottom of the boiler, where they might break if too close with the fire. (See Fig. 8.)

The water in the boiler should reach to within a couple of inches of the top of the jars. Cans may be placed in two or more tiers, separated and supported by slat gratings which allow the steam to penetrate to all parts of every can. The cover of the boiler should fit snugly in order that the steam will be confined and heat the upper part of the sterilizer to the boiling temperature.

Pressure Sterilizers.—Certain vegetables are hard to sterilize except at very high temperatures. Sterilizers using pressure steam will attain these temperatures and the cheapest forms can be bought for about ten dollars. For family use these are unnecessary, the methods

described on page 4 being more convenient, as they require no special equipment.

Where vegetables are to be canned for sale it will usually pay to obtain a pressure cooker, as they are fairly easy to operate. Directions for operating accompany the outfits.

The pressure cooker is fitted with steam gauge, thermometer, release cock and safety valve, and with weight and lever to regulate the pressure. In using, the boiler is first one-fifth filled with hot water. The cans filled, capped and tipped in the usual way, are then placed in the crate and lowered into the boiler. The cover of the cooker is now screwed down, but the *release cock is left open.* Heat is then applied until steam escapes freely from the open cock. This cock is then closed and heating continued until the temperature reaches the desired point. At this point the safety valve should be set for the corresponding pressure (see table). At the same time the release cock is opened slightly, so as to allow a small escape of excess steam. By this means the temperature can be regulated very exactly. The safety valve will open and relieve the pressure if the temperature commences to go too high and it cannot go too low so long as the small escape of steam continues through the release cock. When the heating has continued for the required time, the cooker is removed from the fire, the release cock opened, and when the pressure has fallen to 0 the cans are removed and cooled in water, or the steam may scald the operator. If the cooker is opened before the pressure has fallen to 0 the cans may burst. The larger outfits of this kind are equipped with a small steam boiler for heating, and three or more cookers.

TEMPERATURES F. CORRESPONDING TO LBS. STEAM PRESSURE

Lbs. press	Deg. F.	Lbs. press	Deg. F.	Lbs. press	Deg. F.
1	215.2	6	229.5	11	241.0
2	218.3	7	231.9	12	243.1
3	221.3	8	234 3	13	245.3
4	224.2	9	236.6	14	247.3
5	226.9	10	238.8	15	249.1

Marking.—All containers should be plainly marked with the variety and grade of the product. This can be done by means of a small set of rubber stamps and ink, such as that used by canners, which will stand hot water. They may also be marked after sterilization with gummed labels or wax pencils specially made for writing on tin and glass.

SPECIAL DIRECTIONS FOR VARIOUS FRUITS

Apples.—Apples are canned almost exclusively for use in pies. Any sound fruit will do for this purpose, but Californian commercial canners are limited largely to yellow Bellflowers, yellow Newtowns, and Gravensteins, as these are the chief varieties grown in the state and available culls are chiefly of these varieties. The fruit should be firm and free from bruised spots. Tart apples are to be preferred.

Peeling.—The hand-power peeling and coring machine used in preparing apples for drying can be used if the blade that cuts the apple into thin discs is removed. The peeled and cored fruit is quartered and placed at once in jars or cans. From 20 to 40 per cent of the fruit is removed as peeling and cores. These can be used as jelly material.

Grading.—Two grades are made, the perfect quarters of good size comprising the first grade, and the small and imperfect quarters the second.

Syruping—Cans of fruit are filled at once with boiling water. Jars, to avoid breakage, are filled with water at 150° F. No sugar is used with canned apples ordinarily, because they are usually made into pies before eaten.

Capping and Tipping.—Put the cap in place and seal with the capping steel, then "tip" at once as directed on page 13. If the cans have been filled with hot water, no exhausting is necessary.

Processing or Sterilizing in cans.—Place the cans in the sterilizer of boiling water. If No. 3 cans are used, keep in boiling water 12 to 15 minutes, according to the ripeness and softness of the fruit. If No. 10 cans are used, 15 to 18 minutes are necessary. The same times are sufficient where the heating is done by steam in a closely covered boiler, where no steam pressure is developed.

It will be found convenient to have a number of crates made of heavy wire screen reinforced with iron straps to fit the sterilizer, to hold the cans during sterilizing. One of these can be filled while a full one is in the heater.

Cooling.—As soon as sterilization is complete, remove the cans and cool in a tub or tank of cold water to stop further cooking. If the screen crates mentioned above are used, they may be lifted from the sterilizer with the cans and the whole plunged into cold water.

Marking.—Some sort of an identifying mark should be placed on the cans with canners' ink before or with special pencils immediately

after sterilizing and cooling. Some such mark as A–1 for first grade, and A–2 for second grade on the bottom of the cans will serve to identify them.

Storage and Spoilage.—Before any canned fruit is put on the market, it should be stored at least a month to see if it will show spoilage. It is better to have cans spoil in the store room than on the grocers' shelves. If the fire used to heat the sterilizer is not strong enough, it may take too long to bring the cans to the temperature of boiling water and the "germs" that cause spoilage may not be killed. Usually, however, the trouble is due to leaks in the cans. With an inexperienced operator, leaks often occur around the solder groove of the cap. When the capping operation is well done, there should be very few leaks. Leaks can be detected by bubbles appearing when the cans are dropped into hot water. Leaks permit air to get in and the air brings with it "germs" which cause the fruit to ferment and produce the gas that causes the cans to swell. There should be little spoilage with apples, as they are easily sterilized.

Sterilizing in jars.—Prepare as for cans. The peeled, cored and quartered fruit is placed in the jars which are then filled with boiling water to about three-eighths of an inch of the top. Put the rubbers in place and cover loosely with the caps. Rubbers should be boiled in water with one teaspoonful of baking soda per quart for at least one hour and then soaked for one hour in plain water before using. Otherwise a "rubber taste" may be given.

The jars are then placed in the sterilizer containing water near the boiling point. The water should come to about one-half the height of the jars and there should be a grating or screen between bottoms of the jars and the bottom of the boiler. A slat grating may be placed on top of the first tier of jars and another tier placed on top of this.

The cover of the cooker should fit tight and the water be boiled as quickly as possible. After boiling rapidly for twenty minutes, remove the jars and screw or clamp the caps down tight while the jars are still very hot. Then stand the jars upside down to cool in a quiet place free from draughts.

Apples in Syrup.—Apples to be used as dessert for home use may be canned in a heavy syrup. A 50 per cent syrup is used, made by dissolving one pound of sugar in each pint of water. It should be fairly clear. The peeled, cored and quartered apples are placed in the syrup and boiled slowly in a covered pot until they are cooked sufficiently. This is when they are still firm, but not hard. They should be more or less transparent.

The fruit and syrup are then transferred to cans or to jars first heated in water. The cans and jars are then closed and sterilized, as above, except that sterilization for 5 minutes is sufficient.

Apples in Boiled Cider.—Instead of sugar syrup, "boiled cider" may be used. This is prepared by boiling down apple juice until it is reduced in the proportion of five gallons of fresh juice to one gallon of boiled cider or syrup. All the operations of canning are the same as with sugar syrup.

Pears.—The Bartlett is the best variety for canning purposes. It should be of good size and prime ripe, but not too soft. The fruit is peeled by hand and cored by the coring knife shown on page —.

Grade into Extra Fancy, Fancy and Pie grades after peeling. Cover with hot, 50 per cent, 30 per cent syrups and water, respectively. As pears tend to turn brown rapidly after peeling, they should be placed in the can with syrup as soon as peeled or should be kept under water after peeling until used. As soon as the cans are filled with hot syrup, cap them and tip. Sterilize No. 2½ or No. 3 cans in boiling water or steam at 212° F. for 20 minutes. If sterilized in glass, proceed as with apples, but sterilize for 30 minutes after the water reaches the boiling point.

Peaches.—For canning, peaches must have a good flavor which remains after heating; the texture must be close and the fiber tender; the color should be even and the ripening uniform from surface to pit. Of the cling varieties, the Tuscan and Phillips are very satisfactory and of the freestone, the Muir and Crawford are preferred.

Fruit for canning must be thoroughly ripe in order that the best flavor may be obtained. It may be graded into Extra Fancy, Fancy and Pie fruit before peeling.

Peaches are easily hand-peeled by the use of the peeling knife shown in Fig. 6. Freestones are easily pitted by cutting in half. Cling stones are pitted after peeling by inserting a pitting spoon from the stem end, and rotating it close to the pit. This cuts the pit loose from the fruit. The fruit is then cut in half. The pitting spoon is shown in Fig. 6.

Place in jars or cans and cover the Extra Fancy with a hot 60 per cent syrup, the Fancy with a hot 40 per cent syrup, and the Pie Fruit with water. Then cap and tip.

Freestone peaches require a shorter time of cooking than clingstones owing to the firmness of the latter. Sterilize clings in No. 2½ or No. 3 cans, twenty minutes at 212° F., and freestone peaches fifteen minutes at 212° F. Gallon cans will require thirty to thirty-five minutes. Cool the cans in cold water immediately after steril-

izing. As peaches vary greatly in texture, the times given above are only approximate and must be varied according to the judgment of the canner. It is advisable to run a few trial sterilizations on one-can lots to determine the exact time necessary to give the desired texture to the finished fruit.

In quart or pint jars, Clings should be sterilized thirty minutes or longer at 212° F. and freestones twenty-five minutes. It is also recommended that tests be made on one-jar lots to determine the exact time necessary to give the best results. Peaches in jars, if for the market, should be made attractive by careful arrangement.

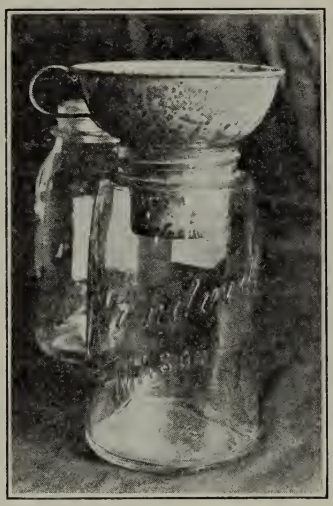

Fig. 9.—Funnel for filling fruit and syrup into jars or cans.

Vertical rows may be built up in the jars if the halves are not too large. Peaches are the most popular of any of the fruits canned. If carefully selected, graded and canned in a heavy syrup, and attractively labeled, there should be little difficulty in disposing of them at a profit.

Commercially, peaches are peeled by dipping in lye to soften the skins and then removing the skins by a strong spray of water. This method is not recommended for home canning, because the machinery required is too elaborate for small scale work.

Apricots.—Apricots for canning should be ripe and well colored, but not too soft. Many canners make the mistake of canning apricots too green. The canned product from such fruit has a "green" astringent taste that no amount of sugar can wholly overcome. If

over-ripe, on the other hand, the fruit cooks down to a jam of unattractive appearance.

Grading.—The fruit should be sorted into three grades before pitting. These grades are *Extra Fancy,* consisting of full sized, prime ripe, well colored fruit; *Fancy,* consisting of sound fruit of fairly uniform and medium size, which may be a little too ripe or a little too immature to go into the Extra Fancy grade or which may have slight blemishes due to scab, etc.; and a third grade, known as *Pie Stock,* which would include soft over-ripe, small, immature and badly blemished, though sound, fruit.

Filling the Cans or Jars.—The fruit should be pitted immediately after grading. To remove the pits the apricots are cut in half with a fruit-cutting knife. The halved fruits are at once thoroughly washed in clean cold water to remove dust and dirt. They are then packed into enameled or lacquered cans or glass jars. The fruit should be packed uniformly and the cans filled full, but not overfull. Jars for market should be packed only with the extra fancy fruit which should be arranged in perfectly straight vertical rows in halves of uniform size and color one above the other. Jars packed in this way are very attractive.

Addition of Syrup.—Apricots require a heavy syrup to bring out their best flavor. For the Extra Fancy use a syrup of 60 per cent sugar (60° Brix or Balling = 32½° Baumé); for the Fancy grade a 40 per cent syrup, and for the Pie grade only pure water.

Sterilizing in Cans and Jars.—Sterilization is conducted exactly as with apples (see page 19) except that a little longer heating is needed. The time of heating in the boiler depends on the size of the cans. For No. 1 and No. 2 eight minutes after the water boils is sufficient; for No. 2½ and No. 3, ten to fifteen minutes while No. 8 and No. 10 cans require twenty to twenty-five minutes. Jars are heated for thirty minutes in boiling water.

Cooling.—The cans are cooled in water and the jars in the air while standing upside down, exactly as with apples. Quick cooling prevents overcooking and injury to the flavor.

Sterilizing at lower temperatures.—The apricots are prepared in the way described and put in cans with a 50 per cent syrup heated to 165° F. The temperature must be verified with an accurate thermometer. The cans are sealed and tipped in the usual way and then immersed in a pot or boiler of water kept exactly at 175° F. No. 2 cans must be kept at this temperature for fifteen minutes, No. 2½ and No. 3 for twenty minutes. The temperature must be closely watched by means of a thermometer kept constantly in the water. If the tem-

perature falls on inserting the cans the time is counted only after it reaches 175° F. The cans on removal are not cooled in water. Left in the air they cool slowly and complete the sterilization.

Apricots put up in this way have more of the fresh apricot flavor than when sterilized at 212° F.

Plums.—This fruit is canned whole in glass or in enamel-lined cans. On account of the high acidity, it is unsafe to use plain tin.

The fruit should be picked when it is beginning to turn soft. If too ripe, it will cook down to a jam in the can and if too green will be too sour and lacking flavor.

Wash the fruit and grade into Extra Fancy, Fancy and Pie grades, the grading being made on appearance, size and degree of ripeness. The prime ripe, large fruit of unblemished appearance should comprise the Extra Fancy grade; the medium-sized sound and prime ripe fruit, the Fancy grade; and the soft, small and blemished fruit, the Pie grade. Fill the cans full and cover the Extra Fancy grade with a hot 50 per cent syrup, the Fancy grade with hot 40 per cent syrup, and the Pie stock with hot water. Cap, tip and sterilize at 212° F. for eight minutes in No. 2 or No. 3 cans if the fruit is soft; if firm, cook 12 minutes. Gallon cans must be cooked twenty-five minutes because of their larger size. Chill the cans in cold water after cooking.

If sterilized in glass, proceed as for apricots, except that the plums are not pitted before placing in the jars. The Green Gage and Egg plums are the varieties most used.

Prunes.—Prunes are not canned commercially, but are perhaps preferable to dried prunes for home use. Select well colored ripe prunes of large size. Wash and place in cans. Cover with a hot 40 per cent syrup. Cap and tip. Process at 212° F. for twelve minutes for No. 2 or No. 3 cans. Chill in cold water after sterilizing.

In jars they are covered with a 40 per cent syrup at 212° F. and sterilized by placing in water at 175° F.; heating to 212° F. and boiling for twenty minutes in the usual way as described for apricots.

Cherries.—Cherries canned without pitting develop a "bitter almond" or "pit" flavor, pleasing to some and disagreeable to others, although the pitted cherries are probably most in demand. Small hand-pitting machines can be obtained from any hardware store for a small price. All pitting machines remove the pits by means of a cross-shaped plunger which lacerates the flesh more or less, and therefore the fruit must be canned immediately after pitting to check spoiling by fermentation. The Royal Anne, a large white cherry, is seldom pitted. Cherries tend to shrivel in heavy syrups or if covered with hot syrups, Only moderately sweet syrups should be used therefore and the cans exhausted by heating before sealing, rather than by adding hot syrup.

Grade the cherries into extra fancy, fancy, and pie grades. Wash thoroughly in cold water. Pit if desired. Fill into cans or jars and add a cold 40 per cent syrup to the extra fancy grade, a 30 per cent to the fancy, and water to the pie stock. Cap. Exhaust cans in water at 150° F. for fifteen to twenty minutes (see p. 15) and tip the ventholes. Sterilize No. 2½ or No. 3 cans in boiling water or steam at 212° F. for eighteen to twenty minutes; No. 2 cans, fifteen minutes; and gallon cans for thirty minutes. Sterilize jars as directed for apples for thirty to thirty-five minutes at 212° F.

Blackberries.—Sort into three grades, making an extra fancy grade of the largest prime ripe fruit, fancy of medium-sized firm fruit, and a pie grade of the soft, small, or under-ripe fruit. Wash and fill into enamel-lined cans or glass jars. Fill the extra fancy cans or jars with cold syrup of 60° Balling, the fancy with 50 per cent syrup, and the pie grade with hot water. See pages 15, 16 for preparation and testing of syrups. Hot syrups should not be used, as they will cause shriveling.

Cap the cans and exhaust by placing in boiling hot water for five minutes. Remove and tip the ventholes and return to the boiling water. No. 2½ or No. 3 cans are kept for twelve minutes at the boiling point of water; No. 2 cans, eight minutes; and No. 10 (gallon), twenty-five minutes. Chill the cans in cold water after cooking.

Jars should be cooked for thirty minutes at 212° F. as directed for apples.

Alternative Method for Blackberries.—Blackberries shrink during cooking and the fruit which fills a can when fresh will shrink to about two-thirds after sterilizing. If the cans are to be well filled, the blackberries must first be cooked slowly in the syrup for fifteen minutes, so that the shrinkage will take place before canning.

The fruit is then filled into the cans or jars hot, and after sealing, sterilized for only five minutes at 212° F. Jars require ten minutes. The extra syrup formed by the juice of the fruit can be used on the next lot or the excess moisture may be boiled off and the fruit made into a preserve before canning.

Loganberries.—Loganberries may be canned in practically the same way as recommended for strawberries. Lacquered cans or glass jars must be used.

Raspberries.—Raspberries shrink very greatly on cooking, so that a can filled with the fresh berries, sealed and sterilized, will show a considerable loss in volume of solid fruit on opening. To avoid this shrinkage in the can, the fruit must be cooked before the cans are filled.

Sort out defective berries and wash. Transfer to a kettle and add an equal volume of sugar. Cook slowly until the fruit has reached the desired consistency. If the syrup is tested at this point by a saccharometer it should test about 50° to 55° Balling. Fill into cans or jars hot. Cap and tip. Sterilize at 212° F.; five minutes for cans and ten minutes for jars.

If there is no objection to shrinkage of volume in the can, the berries may be covered with a hot 50 per cent syrup and sterilized for ten minutes at 212° F. for No. 2 or No. 3 cans, or for twenty minutes for glass jars.

If the berries are to be used only for pies, they may be filled into cans with hot water and No. 2 or No. 3 cans sterilized at 212° F. for ten minutes and gallon cans twenty minutes.

Strawberries.—These berries shrink very badly in volume if cooked in the can.

Grade the berries into extra fancy and pie grades. Stem and wash thoroughly. Place the extra fancy berries in the kettle and add an equal volume of sugar.

Cook down slowly until the syrup will test 50° to 55° Balling. Drain off excess syrup and fill into cans hot. Can, tip and sterilize at 212° F. for five minutes for No. 2 or No. 3 cans. Glass jars may be filled hot and sterilized in boiling water for ten minutes.

The pie grade can be placed in cans, covered with hot water and sterilized for ten minutes at 212° F. for No. 2 or No. 3 cans or twenty minutes for gallon cans.

Currants, Cranberries, Gooseberries.—These fruits are used only for pies, jellies, and jams, and are not commonly canned. They may be put up in enameled cans or in jars in plain water and sterilized at 212° F. No syrup need be used, as it will be found more satisfactory to add the desired sugar when using the fruit later for pies, etc.

The fruit should be washed, placed in cans or jars, which are then filled with boiling water, sealed and sterilized at 212° F. for fifteen minutes. Jars should be filled with hot water at about 212° F. and sterilized at 212° for twenty-five minutes, as directed for apricots, pages 22 and 23.

Grapes.—Muscat grapes are canned commercially in considerable quantities in California and are used chiefly for pies. Thoroughly ripe Muscats are removed from the stems and graded for size and appearance. Only two grades need be made, the large unblemished berries for the extra fancy and the small and imperfect berries for the pie grade.

Fill the cans to the top and add a hot 40 per cent syrup to the extra fancy and plain hot water to the pie fruit. Cap and tip in the usual way. Cook No. 2½ or No. 3 cans for ten minutes at 212° F. and smaller cans for eight minutes in boiling water.

The fruit may be packed in quart or pint jars and sterilized in the usual way for twenty minutes at 212° F.

Figs.—Figs are usually put in glass in the form of preserves. The fruit should be allowed to ripen thoroughly on the tree and must be handled carefully during picking and transferring to the cannery.

In commercial manufacture of fig preserves, the fruit is peeled by a dip of hot lye, followed by washing under a vigorous spray of water, in the same way as with peaches (see p. 22). They are then placed in steam-jacketed kettles with an equal weight of sugar, boiled down to a preserve, packed hot in glass and sealed without further sterilization.

For home use, ripe figs may be used without peeling. After cutting the stems, the fruit is weighed and placed in a preserve kettle or stewpan. For each pound of fruit, one pound of sugar is added and enough water to prevent scorching. Boil down slowly until the hot syrup will test 60° Balling or 33° Baumé, or until the mixture reaches a boiling point 8° above the boiling point of water, which is for most localities 220° F., or until the fruit is well cooked and of a consistency of a heavy preserve. Jars, with their caps and rubbers, are sterilized by heating in boiling water. They are then filled with the boiling hot preserve and the caps screwed down at once. As soon as filled the jars should be placed on their sides and turned occasionally during cooling to insure that the whole interior of the jar is sterilized with the hot fruit. Fruit preserves will not ferment if the sugar content is high enough, but may mold if the jars and contents are not thoroughly sterilized.

Smyrna figs have a thicker skin than the Mission, and therefore are better if peeled before cooking. If thoroughly ripe, this may be done by hand, but it adds greatly to the labor and expense of preparation.

Rhubarb.—From a culinary point of view, rhubarb is a fruit and is very easily sterilized and canned in the same general way as other fruits. Since it is used chiefly as a pie stock no sugar need be used.

Wash the stalks; cut into short lengths and fill into enamel-lined cans or glass jars. Cover with hot water and seal. Sterilize cans twelve minutes at 212° F. and jars twenty minutes at 212° F. The rhubarb shrinks during sterilization, and in order to get a fuller can or jar it should be boiled a few minutes before canning.

Plain tin cans are soon badly corroded by rhubarb and preferably only glass should be used.

Pineapple.—Canned pineapples can be bought at such a moderate price that it will not pay to buy fresh fruit in the California markets for canning.

Oranges.—Oranges must be sterilized in a heavy syrup and at a moderate temperature to be palatable. The fruit must be ripe or almost over-ripe in order that it will not turn bitter.

Thoroughly ripe, sweet oranges are peeled, cut into slices of about half an inch in thickness and placed in enamel-lined cans or glass jars. They are then covered with a 60 per cent syrup, heated to 150° F. and then cans or jars sealed. After sealing these are completely immersed in water at 150° F., which is gradually heated to 175° F. Cans are kept at this temperature for fifteen minutes and jars for twenty minutes. Remove and allow to cool; do not cool in cold water.

Fruit prepared in this way will for a time be delicious, but will gradually deteriorate in flavor after three or four months.

Ripe Olives.—The canning of ripe olives for market would require a more extended discussion than could be given here. The following method of pickling and canning is suited for home use, particularly for the Mission and Manzanillo varieties.

Select large, ripe, well-colored fruit. Prepare a lye solution consisting of four ounces of lye to each gallon of water. Treat the olives with this in earthenware crocks and leave until the lye has well penetrated through the skin. This can be determined by cutting an olive open and is shown by a discoloration of the flesh beneath the skin. Drain off the lye into another container and leave the olives exposed to the air for twenty-four hours. This is to darken the color, and they should be stirred seven or eight times during the process.

Dilute the lye solution already used with one gallon of water to each three gallons of lye and replace on the olives. Stir often and watch the treatment until the lye reaches the pit. Then remove and expose the olives to the air again for eight hours. Cover with water changed twice daily until all taste of lye or bitterness is removed. Make up a salt brine of four ounces of salt to the gallon of water. Place the olives in this for three days. If the brine darkens after the first day change it for fresh brine of the same strength.

Place the olives in cans. Fill with boiling brine of four ounces of salt to the gallon of water. Cap and tip. Heat No. 2, No. 2½, and No. 3 cans for thirty minutes at 212° F. and gallons for forty minutes. Quart or pint jars require thirty-five minutes at 212° F.

If prepared for market, the olives should be graded for size and uniformity of color before canning.

D. SPECIAL DIRECTIONS FOR VARIOUS VEGETABLES

Most vegetables have only a small amount of acid as compared with fruits. This low degree of acidity, as we have seen, permits the growth of certain bacteria which are very difficult to kill by heating. Vegetables therefore are hard to sterilize. Tomatoes, which resemble fruit in respect to their acidity, are an exception.

Usually in sterilizing vegetables temperatures above 212° F. are necessary, or three repeated sterilizations at 212° F. This requires either the use of a

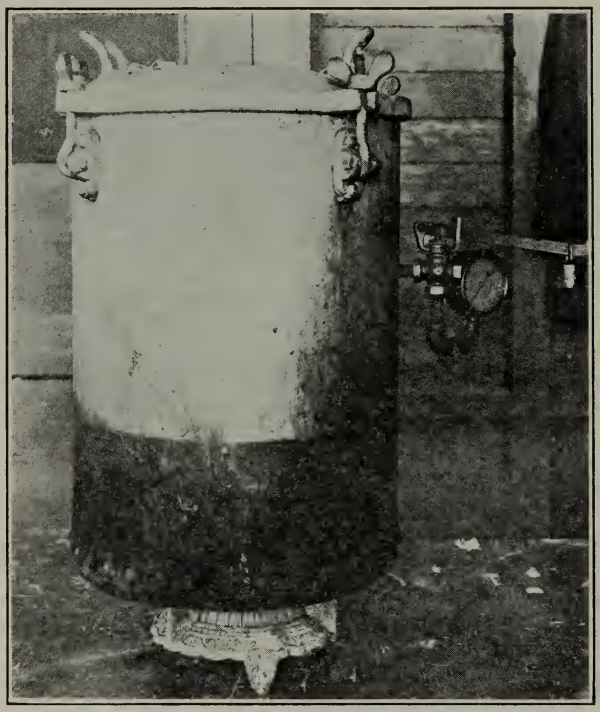

Fig. 10.—A type of steam pressure sterilizer.

steam-pressure cooker or the extra trouble of making three practical sterilizations. Steam-pressure cookers are not difficult to operate and can be obtained at prices as low as ten dollars (see p. 17). Fractional sterilization is accomplished by heating to 212° F. for forty-five minutes on each of three successive days (see p. 4). A single heating of three hours is not always successful.

The new method described on page 4 avoids both the expense of a pressure cooker and the trouble of repeated heatings, and can be highly recommended at least for home use. It consists essentially of making the vegetables slightly acid, thus rendering them as easy to sterilize as fruits.

Artichokes.—Young artichokes only are used. The hard tip is trimmed off and some of the outer bracts removed, leaving only the tender parts. With wide-mouthed jars the trimmed artichokes may be canned whole; with solder-top cans the artichokes must be cut into vertical sections.

They are blanched for five minutes in boiling water (see p. 14), placed in cans or jars and covered with hot 2 per cent brine. They are then capped and tipped immediately and sterilized in a steam cooker at 239° F., or ten pounds pressure. No. 2 and No. 3 cans require twenty minutes and jars thirty. Jars must be filled with boiling hot brine, with precautions against breaking, and sealed immediately before being placed in the cooker. After heating for the required time the cooker must be allowed to cool until the pressure falls to 0 before opening.

Where a steam cooker is not available, three heatings of one hour each to 212° on three successive days may be used (see p. 4). With the method described on page 4, in a brine of 2 per cent acidified with one-fourth of a pint of lemon juice per gallon, a single heating for forty-five minutes for cans and one hour for jars at 212° F. is sufficient.

Asparagus.—Grade into large, medium, and small sizes. Commercial canners make five sizes, but such close grading is not necessary in home canning. Cut into lengths to fit the container. This is conveniently done by making a small box the depth of the can or jar and open at the top and one side. The bud ends of the stalks are placed in the box against the closed end and the butts protrude from the open end. They may be cut off flush with the edges of the open side of the box with a large sharp knife.

Blanch the stalks in boiling water for about one minute for small stalks and two or four minutes for the larger sizes. Pack into jars or cans with the tips up. No. 2 tall square cans are most commonly used. Cover with hot 2 per cent brine and seal. Sterilize No. 2 tall cans fourteen minutes and jars twenty after ten pounds pressure (239° F.) is reached. Chill the cans in cold water. If jars are used the sterilizer must be allowed to cool to 0 pounds pressure before opening, since the jars will explode when the pressure is quickly released.

By use of lemon juice (see p. 4) forty-five minutes for cans and one hour for jars at 212° F. is sufficient. Five ounces of lemon juice is added to each gallon of brine. Three fractional sterilizations of one hour at 212° F. for three successive days (see p. 4) can also be used.

Green Beans.—Green beans are best for canning when very young and tender; the larger and harder the pods and beans become, the lower their value for canning. Beans are usually put up in No. 2 cans.

Grade into a small tender size, grade No. 1, a medium size, grade No. 2, and a large size as grade No. 3.

Snip or string after grading. The two larger sizes should be broken into pieces about 1½ inches long, while the small or No. 1 grade may be canned whole.

Blanch the No. 1 grade two minutes in boiling water and the larger grades for four minutes. Chill in cold water and fill into cans or jars.

Cover with 2 per cent hot brine and seal. Sterilize No. 2 cans thirty minutes at ten pounds pressure (239° F.) and jars forty minutes at the same pressure.

Green beans can be successfully canned by fractional sterilization of one hour each (see p. 4) or in the lemon-juice method (see p. 4) in thirty-five minutes

for cans and forty-five minutes for jars. In this method use one-fourth pint of lemon juice per gallon of brine.

Beets.—Beets should be small and turnip shaped if canned for market. The extra fancy grade may be 1 to 1½ inches in diameter and the fancy over 1½ inches.

Scald in boiling water or in steam until the skin will slip easily. Chill in cold water, peel, cut off the tops and fill into cans or jars. For market purposes jars are ordinarily used.

Prepare a brine containing 2 per cent sugar (or 2⅔ ounces per gallon) and 2½ per cent salt (3¼ ounces per gallon of water). Heat to boiling and fill cans. Cap and tip. Enamel-lined cans should be used.

Sterilize at eight pounds pressure, or 235° F., for thirty minutes for cans and forty minutes for jars. Chill the cans after cooking.

With the lemon-juice method heating to 212° F. for one hour for cans and one and one-half hours for jars is necessary. (See p. 4.)

Three fractional sterilizations for one hour each may also be used.

Carrots.—Carrots can be prepared for the can by washing, scraping and blanching four minutes in boiling water. Fill into cans and cover with hot brine consisting of 2 per cent salt and 3 per cent sugar; or with a sauce made to taste from salt, sugar, butter, and water. Seal. Sterilize at ten pounds pressure for thirty-five minutes. If four ounces of lemon juice is added to each gallon of brine the carrots may be sterilized at 212° F. for one hour or one and one-half hours in jars. If lemon juice is not used, one hour on each of three successive days will be needed. (See p. 4.)

Sweet Corn.—The ears are shucked, silked, and the corn is cut from the cob with a sharp knife. A syrup of one-half pound sugar and one and one-half ounces salt per gallon is made. The corn and a small amount of syrup (enough to cover the corn) are mixed and heated in a pot to boiling. The mixture is filled into cans or jars hot, sealed and sterilized for fifty minutes at fifteen pounds pressure or 250° F. Corn is very hard to sterilize. Cool the cans after sterilizing.

Corn can be sterilized at 212° F. for one and one-half hours if six ounces of lemon juice per gallon of syrup is used.

Peas.—Picking and hulling peas by hand is a very slow process and not to be recommended for commercial canning. Large canneries do the hulling, grading, blanching, and filling of cans entirely by machinery. It is feasible, however, to shell enough peas for canning for home use by hand.

Select as tender peas as possible and shell. Place in a wire basket or in a clean cloth and blanch in boiling water long enough to wrinkle the skin slightly. This will usually be about one to four minutes, depending upon the size and tenderness of the peas.

Fill into cans or jars and cover with a hot brine consisting of 2⅓ ounces salt and 3½ ounces of sugar per gallon and seal. Sterilize cans twenty-five minutes at 240° F. or ten pounds pressure, and jars forty minutes at the same temperature. Cool cans in cold water after sterilizing.

Sterilization of Peas at 212° F.—To the above brine add seven ounces of lemon juice per gallon; fill into containers hot and seal. Sterilize cans for forty-five minutes at 212° F. and jars sixty minutes. If lemon juice is not used, sterilize the cans or jars for one hour each day for three successive days.

Peppers, Pimentos, and Chiles.—These vegetables are usually peeled by causing the skin to slip by roasting or immersing in hot lye solution or in hot oil. The methods are hardly applicable to household use. They have been peeled successfully in the laboratory by immersing from two to three minutes in a boiling lye consisting of 3 ounces soda lye and one gallon of water. They were then chilled at once in cold water and the skins came off easily from the large sweet peppers and pimentos. Small, pungent, tough-skinned Mexican peppers did not yield to this treatment. When peeled in this way, the peppers are obtained soft and pliable and can be folded into the cans after cutting off stems and removing the seed cores.

The peppers need not be peeled for home use and need only be stemmed and cored and heated in boiling water a few minutes to soften them so that they will pack into cans or jars satisfactorily.

Fill with boiling hot water and seal. Sterilize at 212° F. for eighteen minutes in cans and forty minutes in jars. Olive or salad oil may be used instead of water to fill the cans.

Pumpkin.—Cut open the pumpkin; scrape out pulp and seeds and cut the flesh and rind into strips. Boil in water until soft. Scrape the flesh from the rind and mash the pulp through a colander and heat almost to boiling temperature in a double boiler or in a steam retort to avoid scorching. Pack into cans or jars hot and seal. Sterilize cans one hour at 240° F. or ten pounds pressure and jars one and one-half hours at the same temperature.

The lemon-juice method can be used as follows:

Cut the fresh pumpkin into pieces to fit into cans or jars and fill containers with them. Prepare a brine containing 2⅔ ounces of salt per gallon and 4 ounces of lemon juice per gallon. Heat to boiling and fill the cans or jars of pumpkin with the hot brine. Seal. Sterilize cans at 212° F. for one hour and jars one and one-half hours. Pumpkin prepared in this way has kept perfectly and, although it comes from the can rather firm, it has a good flavor and appearance.

Tomatoes.—Tomatoes have a considerable amount of acid which checks growth of heat-resisting bacteria. They are therefore easily sterilized at 212° F.

For canning purposes, the variety used should be smooth and of a deep color. Corrugated tomatoes are too difficult to peel.

Sort the tomatoes and reject those which are spoiled and under-ripe. Place in blanching basket and immerse in boiling water long enough to crack and loosen the skin. This will usually be about one-half to one minute. Remove and chill in cold water. Slip off the skins and remove the cores. Heat to boiling in the juice obtained in coring. Pack tightly into cans or jars hot. Seal. Sterilize No. 3 cans for thirty minutes at 212° F. and No. 10 cans seventy-five minutes at 212° F. if packed hot.

If the tomatoes are packed without the addition of juice, it is known as a solid pack; if juice is added, a standard pack.

Tomatoes may be canned whole to be used for slicing for salads. Select small tomatoes that will go into the jars or cans. Cover with a hot tomato juice pressed from mashed fresh tomatoes. Seal. Sterilize cans twenty minutes at 212° F. and jars thirty minutes.

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